EFFICIENCY OF AQUATIC HABITAT INVENTORY SURVEYS IN THE ASSESSMENT

OF FISH SPECIES PRESENT

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The Ontario Fisheries Acidification Report Series has been established by the Ontario Ministry of Natural Resources to document findings from studies conducted as part of the Fisheries Acidification Program. These reports are intended to contribute to our knowledge of acidification effects, but they should also be of general interest to fisheries managers.

These reports are basically progress reports. Much of this information will appear later in journal papers.

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EFFICIENCY OF AQUATIC HABITAT INVENTORY SURVEYS IN THE ASSESSMENT OF FISH SPECIES PRESENCE

ABSTRACT

We compared Aquatic Habitat Inventory Survey (AHIS) data on fish species presence in lakes with similar data collected from other fish sampling studies to examine biases in the AHIS data set. The more intensive studies were of two types: 1) short term studies (88 lakes) that were conducted over a period of about 3 to 5 days, and 2) long term studies (59 lakes) that were conducted more intensively, over several seasons or years. AHIS caught on average 1.56 fewer species per lake than the short term studies, and 4.37 fewer species per lake than the long term studies. Fish species length (log transformed) was positively correlated with an index of AHIS efficiency. The larger species tended to be game and commercial fishes, and were generally captured by AHIS in more than 70% of the lakes where they were known to be found. Smaller fishes such as minnows and darters were generally poorly represented in the AHIS sample. The number of species missed by AHIS was negatively correlated with lake area for the short term studies only, and was positively correlated with mean depth for the long term studies. Differences in sampling effort, gear type and fish distribution appear to account for the observed biases. AHIS serves the needs of resource managers by providing an initial characterization of the fish community in a lake. It is especially good at determining the presence of larger resource species such as lake trout, brook trout, walleye, yellow perch, and smallmouth bass.

INTRODUCTION

The Aquatic Habitat Inventory Survey (AHIS) program was established by the Ontario Department of Lands and Forests (now Ontario Ministry of Natural Resources, OMNR) in 1968 to develop an inventory of the physical, biological, and chemical conditions of Ontario lakes and streams (Goodchild and Gale 1981, Dodge et al. 1985). Approximately 10,000 lakes have been surveyed in this program (Goodchild and Gale 1981). AHIS typically involves a single sampling effort, about three days to one week in duration. The resulting information has been used extensively for various management exercises (e.g. Anonymous 1978, Olver et al. 1979) and scientific studies (e.g. Johnson et al.1977, Minns 1981, Eadie and Keast 1984). The Fisheries Acidification Study, in particular, has made extensive use of AHIS data for making province wide predictions of acid rain impacts (Beggs et al. 1985, Beggs and Gunn 1986, Wales and Beggs 1986). However, uncertainty of the inherent biases have hampered our full use of this large existing data base. In particular, the adequacy of AHIS's single sample for representing fish species presence in a lake has not been assessed.

In this study we compare AHIS data on fish species presence with similar data collected from more intensive fish sampling studies. Also, we examine whether bias in fish species presence from AHIS data is correlated with lake size and fish length. This follows a previous report by Green (1985) and summarizes her major findings with some new analyses of the data.

METHODS

The published literature and unpublished OMNR data sets from Fisheries Assessment Units (FAU), Fisheries Research Units (FRU) and the Fisheries Acidification Study were searched for fish species presence data for lakes in the AHIS data set. The OMNR data were obtained through questionnaires to FAUs and FRUs. Fish data were selected from the FAUs and FRUs for comparison with AHIS data if the sampling effort was considered more intensive than AHIS. Fish data were selected from the other sources if they were collected, at minimum, in accordance with AHIS guidelines (Dodge et al. 1985). Fish data used in this study can be found in Appendix 1.

The selected studies (Table 1) fell naturally into two groups. First, most short term studies (88 lakes) were conducted at a single point in time of short duration, similar to the AHIS (i.e. overnight gill net sets for one to three sampling days). Data for lakes that were sampled more than once by the same or another researcher were combined so that each lake was represented by a single data point. Second, long term studies (59 lakes) were conducted more intensively, over a longer period of time (i.e. seasonal sampling for one or more years using a variety of fishing gear). Because of differences in fishing effort between short and long term studies we kept separate the analyses of these two studies. More complete descriptions of the sampling gear and effort can be found in the studies listed in Appendix 2. In almost all cases the long and short term studies were conducted after the initial AHIS was performed.

The differences in fish species presence between AHIS and other studies were examined in relation to lake morphometry (area and depth) and fish length. Lake area, mean depth, and maximum depth of each lake

were obtained from the AHIS (Appendix 4). The total length of each fish species was assigned the median length of ranges given by Scott and Crossman (1973). Because length of the American eel (Anguilla rostrata) was not available from Scott and Crossman (1973) and because its capture generally requires specialized species-specific fishing gear, it was not included in the fish length analysis. To test for fish species presence bias in AHIS related to fish length, we calculated an index of AHIS efficiency for each species in each of the short and long term data sets as follows:

$$\text{AHIS efficiency index} = \frac{100 \times \#\text{ of lakes in which species was found by AHIS}}{\#\text{ of lakes in which species was found by all studies}}$$

RESULTS

AHIS was less successful than the short and long term studies in determining the fish species found in lakes. AHIS caught on average 1.56 fewer species per lake than the short term studies (paired t-test: $t=4.81$, $p<0.001$) and on average 4.37 fewer species per lake than the long term studies (paired t-test: $t=7.28$, $p<0.001$). The number of species caught by the long term studies (Y) could be predicted by the number of species caught by AHIS (X) using the following regression equation (Figure 1):

$$Y = 0.620\ X + 7.96;\quad R^2 = 0.36,\ P<0.001.$$

AHIS was less successful than the short and long term studies at catching smaller fish species. Fish species length (log transformed) was positively correlated with the index of AHIS efficiency in the long term studies (Figure 2A, $r=0.47$, $p<0.001$), but not in the short term

studies (Figure 2B, r=0.21, p=0.18). Muskellunge (Esox masquinongy, OMNR No. 132) were found in just one short term study lake, and thus, the muskellunge estimate of the AHIS efficiency can not be treated with confidence. Removal of muskellunge from the short term studies resulted in a significant correlation between fish length and AHIS efficiency index (r=0.37, p<0.02). The larger species of game and commercial fishes, such as walleye (Stizostedion vitreum, OMNR No. 334), yellow perch (Perca flavescens, OMNR No. 331), brook trout (Salvelinus fontinalis, OMNR No. 80), lake trout (Salvelinus namaycush, OMNR No. 81), lake whitefish (Coregonus clupeaformis, OMNR No. 91), northern pike (Esox lucius, OMNR No. 131), and smallmouth bass (Micropterus dolomieui, OMNR No. 316), were well represented in AHIS samples (Table 2). Smaller fishes, such as the minnows (OMNR No. 180 - 229) and darters (OMNR No. 335 - 346), generally were collected by AHIS in less than 70% of the lakes where these fishes were known to be found (Figure 2).

AHISs conducted prior to 1973 were not concerned with small fish but subsequent AHISs had a greater variety of gear to reduce size bias (G. Goodchild personal communication). However, compared to the short and long term studies, we found that post-1973 AHISs were not more successful than pre-1973 AHISs in determining species presence.

The tests for relationships between AHIS success and lake morphometry produced two equivocal results. First, the number of species missed by AHIS compared to the other studies was positively correlated (r=0.386, p=0.003) with mean depth for the long term studies only (Table 3). The number of species missed by AHIS was not significantly correlated with maximum depth in either of the short or long term studies. Second, the number of species missed by AHIS was

negatively correlated with lake area for the short term studies ($r=0.259$, $p=0.014$) only (Table 3). Because the Kawartha Lakes FAU used limited fishing gear in its sampling program and its lakes comprised the largest lakes among the long term studies (Appendix 2 and 4), it was expected that these lakes would substantially bias the correlation analysis. However, exclusion of these lakes made no qualitative difference to our results (Table 3).

DISCUSSION

AHIS generally caught fewer species than the other studies in the same lakes. Clearly, our study strongly implicates size selectivity by AHIS on the fish species in these lakes. AHIS misses fewer large species of fish. Because one of its objectives is to provide information for management of game and commercial fishes, such a bias is recognized and is there by design. These fishes, including the salmonids, esocids, percids, and centrarchids are often the largest in these lakes. Gill nets, the primary fishing gear of AHIS, tend to be more efficient at catching larger fish and even gear designed to be selective for smaller fish tend to be less efficient than similar gear designed to be selective for larger fish (Hamley 1975). Most of the long and short term studies used a variety of other gears designed to catch smaller species, for example, various types of minnow traps and seine nets (See Appendix 2).

The precision of our estimates of the index of AHIS efficiency (Figure 2) is infuenced by sample size of the lakes in which a fish species was found. For example, in addition to muskellelunge in the short term studies, the AHIS efficiency indices for brown trout (Salmo trutta, OMNR No. 78) and sauger (Stizostedion canadense, OMNR No. 332)

in the long term studies also depart from the general trend of the data (Figure 2) and also have a sample size of one. Therefore, AHIS efficiency indices in this report are not meant to be generally applied to other work. Rather these indices are presented to illustrate the general bias in AHIS relative to fish length.

Microhabitat specialists should be missed by AHIS more often than generalists because all microhabitat types may not get sampled during the limited duration of AHIS. For instance, consider the white sucker (Catostomus commersoni, OMNR No. 163), pumpkinseed (Lepomis gibbosus, OMNR No.313), and yellow perch, for which we have precise estimates of AHIS efficiency index (all were found in more than 50% of both long and short term study lakes, and they showed good correspondence in AHIS efficiency indices between long and short term studies). The indices for white sucker and pumpkinseed fall directly along the general trend predicted by length for all species (Figure 2). However, the indices for yellow perch indicate that they were captured in more lakes than this analysis would predict by size alone. Yellow perch are one of the most ubiquitous of any of the species captured in this analysis whereas pumpkinseed tend to be found in vegetated areas and white suckers in nonvegetated areas.

AHIS missed more fish species in deeper long term study lakes. Effort in these studies was not uniform by gear type or fishing time across all lakes either within or between studies. Studies used different gear, and there may have been a tendancy toward the use more efficient methods on lakes with a greater mean depth.

AHIS missed more fish species in smaller short term study lakes. Larger lakes require more time to collect bathymetry and water quality

data and sometimes receive more fishing effort by AHIS crews than smaller lakes (H. Schraeder personal communication). Consequently, in larger lakes AHIS may sample more types of habitat. This additional effort should result in additional species in a manner typical of asymptotic species area relationships (Pielou 1969). Fishes that are relatively few in numbers or patchily distributed require more effort to locate than more abundant or ubiquitous species.

In addition, the long term studies typically spent much more sampling effort, over more seasons than AHIS. Fishes that spawn in streams during late spring or summer, for example blacknose dace (Rhinichthys atratulus, OMNR No. 210; Scott and Crossman 1973), may have been unavailable for capture by AHIS, but were available at other times when the long term studies sampled the lakes.

Most of the long and short term studies were conducted after the AHIS on the same lake. Researchers in the subsequent studies had the opportunity to obtain the AHIS results and should have at minimum caught the same species as AHIS by taking these results into account.

In summary, AHIS serves the needs of resource managers by providing an initial characterization of the fish community in a lake. AHIS is especially good at determining the presence of larger resource species such as lake trout, brook trout, walleye, yellow perch, and smallmouth bass. Therefore, our use of AHIS data for province wide predictions of effects due to acidification on some of these fishes (e.g. Beggs et al. 1985, Beggs and Gunn 1986, Wales and Beggs 1986) has been validated. However, we need more detailed data on smaller fishes such as cyprinids if the AHIS data is to be used in the future to manage these species.

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AHIS and Fish Species Presence

Table 1. Sources of fish species presence data for comparison with AHIS in Ontario lakes.

Data Source	Number of lakes
Short term studies	
Harvey and Lee (1980a)	16
Harvey and Lee (1980b)	17
Malinsky (1984)	18
Somers (1980)	25
Stewart (1983)	17
Long term studies	
Algoma Fisheries Assessment Unit (ALFAU)	8
Algonquin Fisheries Assessment Unit (APFAU)	10
Haliburton-Hastings Fisheries Assessment Unit (HHFAU)	9
Kawartha Lakes Fisheries Assessment Unit (KLFAU)	6
Rideau Lakes Fisheries Assessment Unit (RLFAU)	10
Age and Growth Fisheries Research Unit (AGFRU)	5
Brook Trout Fisheries Research Unit (BTFRU)	6
Thunder Bay Fisheries Research Unit (TBFRU)	5

Table 2. Index for AHIS efficiency for the most commonly found game and commercial fish species.

Fish species	Index of AHIS efficiency	
	Long term studies	Short term studies
Brook trout	71	74
Lake trout	86	89
Lake whitefish	83	86
Northern pike	100	70
Smallmouth bass	85	84
Walleye	80	86
Yellow perch	89	89

Table 3. Correlations the number of fish species missed by AHIS with lake morphological variables. Parentheses indicate values with Kawartha Lakes FAU lakes excluded from analysis. Lake area was log transformed prior to analysis.

	Long term studies		Short term studies	
Lake morphological variables	r	p	r	p
Lake area	-0.201 (0.058)	0.127 (0.681)	-0.259	0.014
Mean depth	0.386 (0.297)	0.003 (0.031)	0.115	0.285
Maximum depth	0.215 (0.124)	0.103 (0.375)	0.061	0.586

AHIS and Fish Species Presence

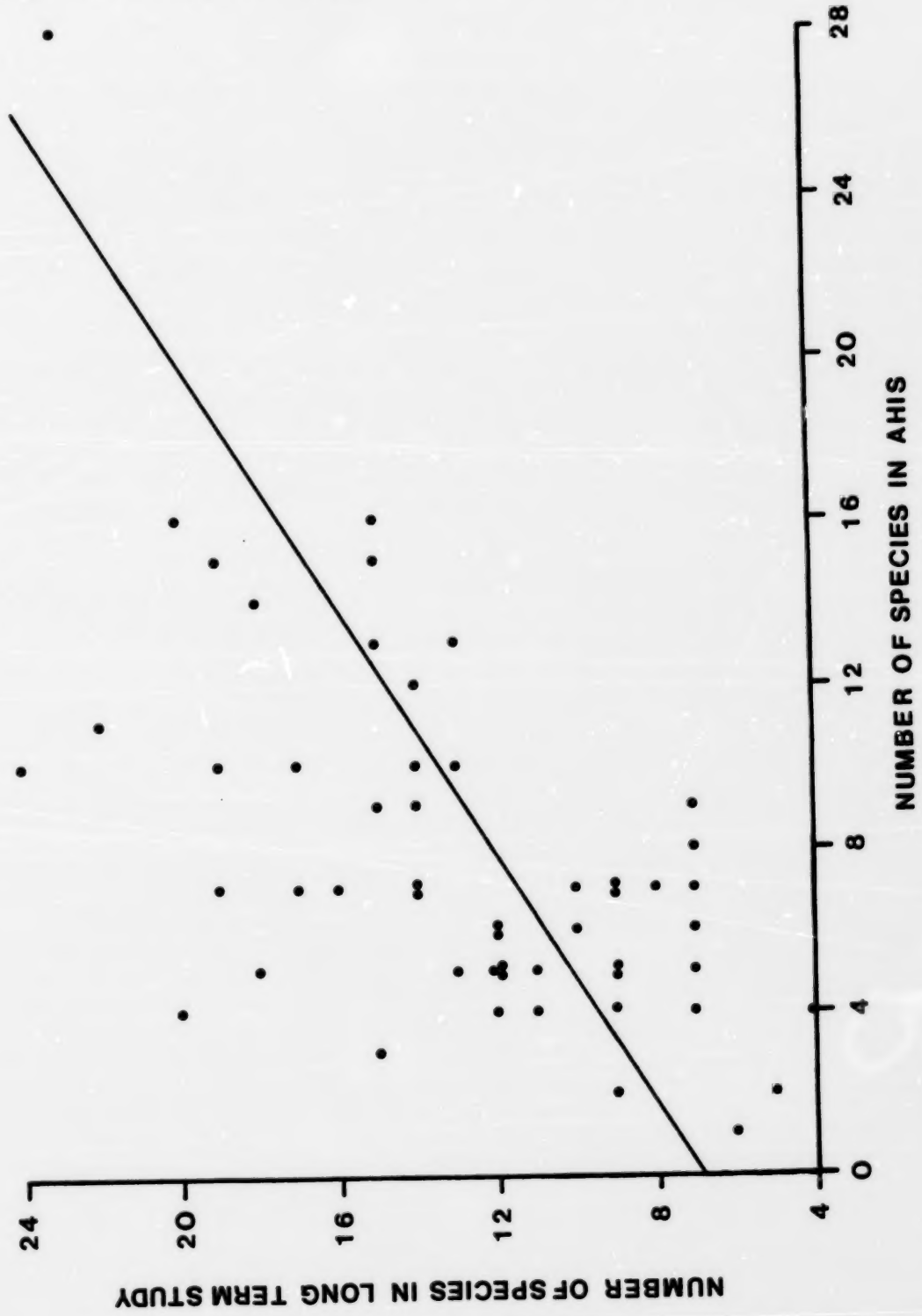

Figure 1. Relationship between the number of species collected by the AHIS and the number of species collected by the long term study in a lake. The equation for the regression line is given in the text.

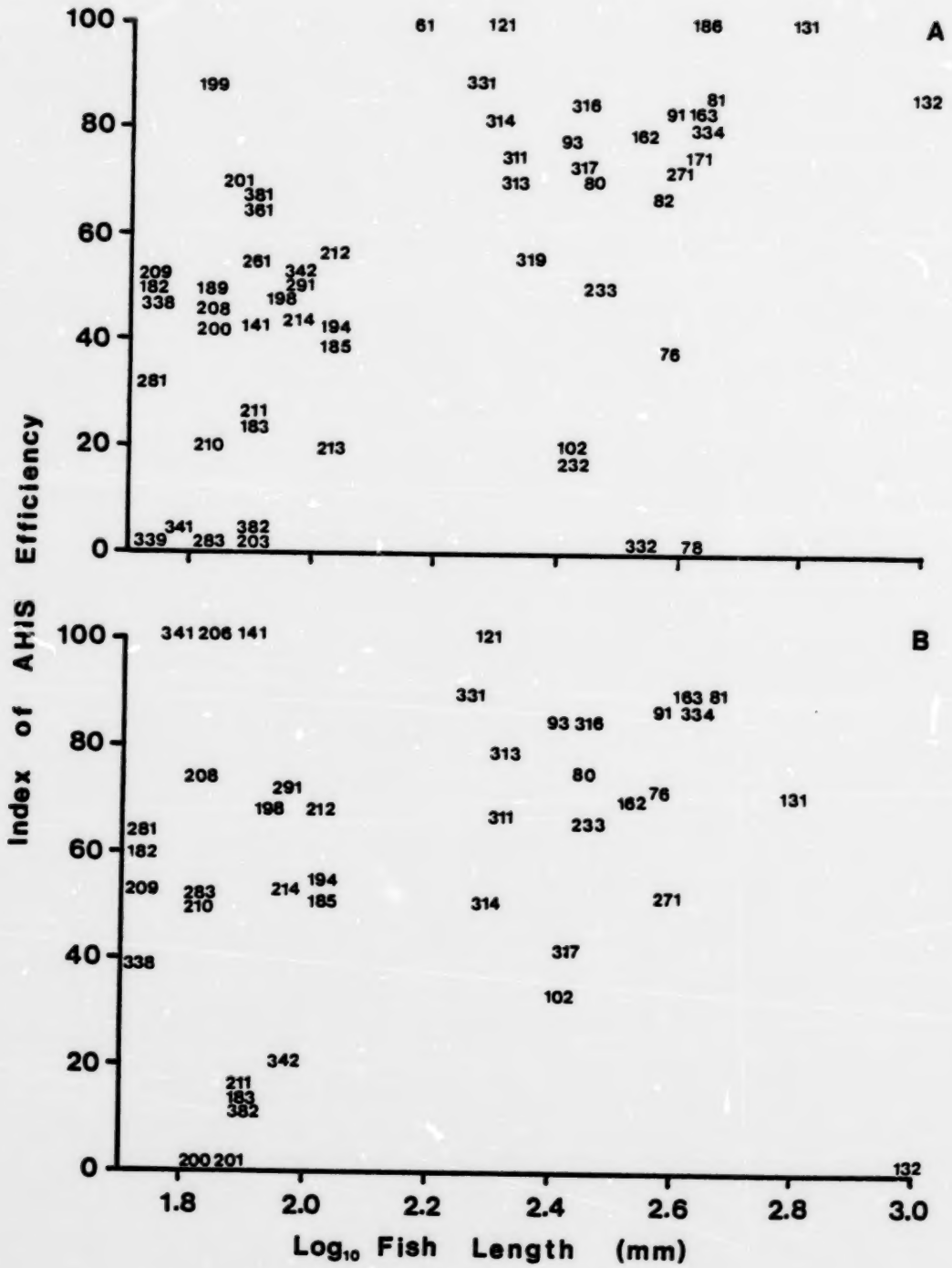

Figure 2. The length of each species plotted against the index of AHIS efficiency. Numbers refer to OMNR species codes (Appendix 3). A - long term studies. B - short term studies.

Appendix 1. The presence of each fish species in each lake in our analyses. The presence of each species is indicated by a number (1, 2, or 3) that refers to the study in which the species was found, as follows: 1 - found by both AHIS and short or long term studies, 2 - found by AHIS only, and 3 - found by short or long term studies only.

Lake	Lat	Long	Species												
			61*	76	78	80	81	82	91	93	102	121	131	132	141
SHORT TERM STUDIES															
Aloft	4818	8427					1								
Andre	4808	8437													
Arliss	4803	8443				2									
Barry	4821	8420				1									
Basshaunt	4507	7828					1		3						
Bauldry	4806	8439				1	1								
Bell	4532	8002								2					
Bell	4608	8111							1	1			1		
Big Porcupine	4527	7837				3	1								
Bigwind	4503	7903		3		1	1								
Black Trout	4803	8450				3	1		1						
Blackwater	4525	7949											3		
Bonnechere	4528	7835					1								
Borzoi	4802	8425				1	1						3		
Buck	4523	7900					1								
Buck	4541	7910					1								
Carlyle	4603	8117								1			1		
Catfish	4806	8448								1			1		
Chub	4513	7859		3											
Clear	4511	7843		2			3								
Clear	4516	7947					1		2	3		2			
Crown	4526	7840				1									
Dickie	4509	7905													
Evangeline	4608	8152								1			1		
Fawn	4510	7915				2									
George	4602	8124				3	1		2	1			1	3	
Goetz	4807	8439				3	1								
Gullfeather	4506	7901													
Gun	4512	7850				3									
Healey	4505	7911													
Heeney	4508	7906													
Hele	4607	8134					1			1					
Isabella	4524	7949							2	2		1	1		
Ishmael	4607	8136					1			1			2		
Izaak	4644	8318				1									
Johnie	4606	8114							1	2			1		2
Kakakise	4603	8119					3			1			1		
Killarney	4604	8121								1					

* OMNR species code (see Appendix 3)

Appendix 1 cont'd.

Lake	Lat	Long	Species												
			61	76	78	80	81	82	91	93	102	121	131	132	141
SHORT TERM STUDIES															
Kimball	4521	7841				2	1		1						
La Cloche	4608	8203								2			1		
Leech	4503	7906													
Lena	4804	8441				1									
Leonard	4504	7927		1					1						
Little Clear	4524	7859				3	3								
Little Kennisis	4515	7835					1								
Little Sequin	4523	7948					2		1	3		1			
Long	4542	7911					1				1				
Low	4606	8134					1			1					
Mahzenazing	4604	8110								1			2		
Manetawan	4540	7859				1									
Maple	4522	7948							1	1		1			
McKay	4503	7910		2											
Mildred	4804	8441				1									
Molybdenite	4803	8458													
Moot	4508	7910													
Moran	4801	8446													
Muriel	4603	8126							2	2					
Mutton	4521	7946				2							3		
North Grace	4526	7832				1	2								
Norway	4605	8118													
Nunikani	4512	7844					1								
Owl	4608	8208											1		2
Parks	4807	8437				1									
Perry	4813	8437				1									
Ponsford	4521	7941								3					
Rain	4537	7856					1								
Raven	4512	7851					1								
Red Pine	4512	7842				2	1								
Roller	4755	8450								3			1		
Sausage	4822	8433							3	1			3		
Selkirk	4813	8436				2									
Seymour	4645	8314				2	1								
Shawanaga	4534	7959								1					
Sherborne	4511	7847					1								
Solitaire	4523	7901				3	2		2		3				
Strobus	4819	8424											3		
Sugar	4522	7946								1			3		
Swan	4530	7842					1				3				
Terry	4604	8117											1		
Tim	4545	7902				2	1								
Toodee	4645	8310				1	1								
Tyson	4607	8107					1			1			1		

AHIS and Fish Species Presence

Appendix 1 cont'd.

Lake	Lat	Long	Species												
			61	76	78	80	81	82	91	93	102	121	131	132	141
SHORT TERM STUDIES															
Vanreek	4802	8438		2											
Walker	4522	7904					3								
Wallace	4808	8432				1									
Ward	4757	8445				1									
West Andre	4809	8440													
Wing	4802	8453		2		3									
LONG TERM STUDIES															
Astonish	4634	8250				1									
Aylen	4537	7751					1		1						3
Balsam	4435	7850												1	1
Billy	4538	7807		1		1	3	1							
Buckhorn	4429	7823												1	
Charleston	4432	7600	1				1		2	1			1		
Chemung	4425	7822												1	2
Clean	4515	7832				3	1			2	3				
Clear	4433	7628					1			1					
Decourcey	4859	8914							1	2			1		
Delano	4532	7834					1								
Devil	4435	7627					1			1			1		
Dickey	4447	7744				3	1			3					3
Dickson	4547	7812				1	3		3	3					
Disraeli	4907	8859					1			1			1		
Drag	4505	7824		3	3	3	1		1	1					
Dropledge	4516	7731				1									
Elliot	4623	8242				3	1		1	1		1			
Flack	4635	8247					1								
Gong	4705	8332				1	1								
Goulais	4710	8340		3		1	1								
Havelock	4517	7838		2		1	3								
Hicks	4522	7750				1									
Johnson	4516	7837		2		1	1								
Kelly	4515	7837				2	1								
Kennisis	4513	7838					1								
Koshlong	4458	7829					1					1			
Lavielle	4551	7814				1	1		1	1	3				
Long	4448	7615											1		
Louisa	4528	7829				3	1								
Macdonald	4514	7834				3	1		2		3				
Meach	4518	7808				1									
Megisan	4715	8332				3	1								
Mica	4427	7633											1		

Appendix 1 cont'd.

Lake	Lat	Long	Species												
			61	76	78	80	81	82	91	93	102	121	131	132	141
LONG TERM STUDIES															
Myra	4538	7821				1		3							
Opinicon	4434	7619	1										1		2
Oram	4538	7806		3		1		3							
Pigeon	4427	7830												1	2
Redrock	4546	7828				1	1	1	2		3				
Rice	4412	7810				3								1	
Rideau	4445	7613	1				1		1	1		2	1		
Ryan	4541	7806		1		1		1							
Saddle	4657	8347				1									
Salmon	4432	7630					1			1					3
Scugog	4410	7850								3				1	
Shrew	4542	7805		1		1		1							
Sill	4646	8415				1									
Smoke	4531	7841				2	1		3	3	1				
Sydenham	4425	7633								1			1		
Timberwolf	4541	7848					1								
Timmus	4840	8905				3									
Turtle	4439	7815					3							3	
Twelve Mile	4501	7843				3	1		1	1		1			
Upper Rideau	4441	7620	1										1		
Walkinshaw	4838	8904				3									
Westward	4529	7847				1									
White Partridge	4550	7806				1	1			1					
Whitelily	4840	8905													
Whyte	4505	7735				1	1								

Lake	Species															
	162	163	171	182	183	185	186	189	194	198	199	200	201	203	206	208
SHORT TERM STUDIES																
Aloft		1		3	3	3						3				
Andre		1		3	3											
Arliss		1				3										
Barry		1		1		3				1		3				
Basshaunt																
Bauldry	1	1				1				1						
Bell		1		1					3	3		3				
Bell		1							1							

AHIS and Fish Species Presence

Appendix 1 cont'd.

Lake	Species															
	162	163	171	182	183	185	186	189	194	198	199	200	201	203	206	208
SHORT TERM STUDIES																
Big Porcupine	2	3			3											
Bigwind		1		1					1							1
Black Trout	1	1		1	3	1							3			
Blackwater		1														
Bonnechere				1												
Borzoi	1	1		1	3	1										
Buck		1														
Buck		1		1	3	2										
Carlyle		2														
Catfish		1				3			3				3			
Chub		1							3							
Clear				3												
Clear		2														
Crown				3												
Dickie		1		3					3							
Evangeline		1							2							2
Fawn		1		3					1	3						
George		1														
Goetz	1	1		2		1				1						
Gullfeather		1							3			3				
Gun		1							1							
Healey	2	3							1	1						
Heeney		1										3				
Hele																2
Isabella		1														
Ishmael									2							
Izaak		1		2												
Johnie		1														
Kakakise		1		2					1	2						2
Killarney																
Kimball		1				2				1						
La Cloche		1								2					2	2
Leech		1														
Lena	3	1				3										
Leonard		3							1							
Little Clear		1		3					3	1						
Little Kennisis	3	3														3
Little Sequin		1														
Long		1				1				1						
Low		3							2							
Mahzenazing		1														
Manetawan		1								3						1
Maple		1														
McKay		1							3							

Appendix 1 cont'd.

Lake	Species															
	162	163	171	182	183	185	186	189	194	198	199	200	201	203	206	208
SHORT TERM STUDIES																
Mildred	3	1			3	3										
Molybdenite						1										
Moot		1							3							
Moran		1		3	3	1										
Muriel									2							
Mutton		1														2
North Grace		1		3		3				3						3
Norway																
Nunikani	2	1														
Owl									1							
Parks		1		3	3	3										
Perry				2		3										
Ponsford		1														
Rain		1								3						
Raven		1		2					2	2						2
Red Pine	3	1														
Roller		3							1						1	
Sausage		1														
Selkirk				1	3											
Seymour	1	1		1	1	3				1						3
Shawanaga		1														
Sherborne		1							2	2						
Solitaire		1				3				3						
Strobus		1				3						3				
Sugar		1							2							
Swan	2	3							3	3						
Terry																
Tim		1		1	3	1			3	3						
Toodee		1		1	1				3	1						
Tyson		1							3							
Vanreek		1		3		3										
Walker									3							
Wallace		1				1				1						
Ward		3		1	3	1										
West Andre		1		3	3											
Wing		1				1										

Appendix 1 cont'd.

Lake	Species															
	162	163	171	182	183	185	186	189	194	198	199	200	201	203	206	208
LONG TERM STUDIES																
Astonish		1		1		3										
Aylen	1	1								3						3
Balsam		1							1							1
Billy		3		2					3							
Buckhorn		1					1		1		1		1			1
Charleston		3							3		2					2
Chemung		1					1		1				1			1
Clean	2	1										3	3			3
Clear		1														3
Decourcey		1				3										
Delano	3	1		1		3			3	1						3
Devil		3	2						3			3	2	3		3
Dickey		1		3	3	3			3	3						3
Dickson	3	3			3	3			3	1						1
Disraeli		1				3						2				
Drag	1	1		1		3			3	3						3
Dropledge		3		3	3											
Elliot	1	1				2				3						
Flack	1	1		3		3			3	3						
Gong	3	1	2	3						1		3				3
Goulais	1	1		3						2						
Havelock		1														
Hicks		1		3	3				1	1						3
Johnson	3	1				3			3							1
Kelly	1	1							3	3		3				1
Kennisis	1	1		1		1			2				1			1
Koshlong		1			3				3							3
Lavielle	1	1		3		1			1	1						1
Long		3							1		2					1
Louisa	1	1		1		3			3	3						1
Macdonald		1		3						3			3			3
Meach		1		1	3				3	3						
Megisan	1	1				3				3						
Mica									2							3
Myra				3	3			3								
Opinicon		1							2		2					2
Oram		3		1					3	1						
Pigeon		1		2			1	2	1		2	3	1			1
Redrock		1		3		3			3	1		3				3
Rice		1			2		1		2			2	2			2
Rideau		1	3						1	3	2	1				1
Ryan									3							
Saddle									3							
Salmon		1							3		3			3		3

Appendix 1 cont'd.

Lake	Species															
	162	163	171	182	183	185	186	189	194	198	199	200	201	203	206	208
LONG TERM STUDIES																
Scugog		1				1	1		1				1			1
Shrew		1		2												
Sill		2		1		1						1				3
Smoke		1							3	3		3				3
Sydenham		3							1							3
Timberwolf		1				1				2						3
Timmus	1			3	3	1										
Turtle		1														
Twelve Mile		1							3	3			3			3
Upper Rideau		1	1						1		2					1
Walkinshaw	1				2	3										
Westward		1		1						1		1				
White Partridge	2	3		3		1				1						3
Whitelily	1			1	1	3										
Whyte		1								3						

Lake	Species															
	209	210	211	212	213	214	232	233	251	261	271	281	283	291	311	313
SHORT TERM STUDIES																
Aloft	3					3					1		3			
Andre	1	2	3			1						3				
Arliss	3											1				
Barry	2					3						1				
Basshaunt				1				1								1
Bauldry	1		3			3										
Bell				3		1										1
Bell								1							1	1
Big Porcupine						3		1			3					
Bigwind	1			2				3								1
Black Trout	2											3	1	1		
Blackwater								1						2	3	1
Bonnechere				1		3						3				
Borzoi	3										3		1	1		
Buck				3								3				
Buck			3	3		3										
Carlyle								1							1	1
Catfish											1			3		

Appendix 1 cont'd.

Lake	Species															
	209	210	211	212	213	214	232	233	251	261	271	281	283	291	311	313
SHORT TERM STUDIES																
Chub				2				3								3
Clear				3												2
Clear															3	3
Crown				1		3		1				1				
Dickie				3		3		1								1
Evangeline								1							1	1
Fawn				1		3		1						3		1
George								1			2				1	1
Goetz	3					1										
Gullfeather				3												3
Gun				1				3								1
Healey				1				1								1
Heeney				3				1								1
Hele								2							1	1
Isabella								3							3	3
Ishmael								2							1	1
Izaak	2											1				
Johnie								1							1	1
Kakakise	2					2		1							1	1
Killarney								1							2	
Kimball											1					
La Cloche								1			3				1	1
Leech								1							1	1
Lena	1											1				
Leonard								1							3	1
Little Clear				1		3		1			3					1
Little Kennisis				1				3							3	1
Little Sequin								2						2		3
Long				1		2		3			1					
Low															1	1
Mahzenazing															1	2
Manetawan				1		1		3								3
Maple															3	3
McKay								1						2	1	1
Mildred	3		1	2								1	1			
Molybdenite																
Moot								1								1
Moran												1				
Muriel								1							1	1
Mutton								1							3	1
North Grace	3			1												1
Norway																
Nunikani				3				3								3
Owl								1							1	1

Appendix 1 cont'd.

Lake	Species															
	209	210	211	212	213	214	232	233	251	261	271	281	283	291	311	313
SHORT TERM STUDIES																
Parks	3		3	1												
Perry	2											1				
Ponsford								3								3
Rain				1				3			3					
Raven				2		2		1			3					1
Red Pine								3							3	1
Roller															3	
Sausage																
Selkirk	1											1				
Seymour	1	3		1								1				
Shawanaga															1	1
Sherborne				2				3							3	1
Solitaire	3			3				2			1					
Strobus																
Sugar				2				3								1
Swan				3				3			3					3
Terry								1							2	1
Tim						1		3					1			1
Toodee	3			2		1						1				
Tyson								3							1	1
Vanreek			3	1												
Walker				2												3
Wallace				2							3	3				
Ward				3								3				
West Andre	3		3	3								3				
Wing																
LONG TERM STUDIES																
Astonish				1		3						3				
Aylen	3			3				3			1	3				3
Balsam	1			1			3	1			3	1		3	1	1
Billy	3			3				1								3
Buckhorn								3							1	1
Charleston							3	3	3	2	1				1	1
Chemung				1				1				1			1	1
Clean											1					3
Clear						1	3	1								1
Decourcey														3		
Delano	3			1		3						3				1
Devil							3	3		3					3	1
Dickey					3			2	3			3			1	1
Dickson	3			3		3		3			3					1
Disraeli											1					

AHIS and Fish Species Presence

Appendix 1 cont'd.

Lake	Species															
	209	210	211	212	213	214	232	233	251	261	271	281	283	291	311	313
LONG TERM STUDIES																
Drag	3			3		3		1				3			3	1
Dropledge	1															
Elliot				3				1			1	2			1	3
Flack				3							1	3			3	
Gong	3			1		1						3				
Goulais			3	1												
Havelock	1		3	1		3										
Hicks	3			1	3							3				
Johnson								2							3	
Kelly								3							3	3
Kennisis			1	1		1		1							3	1
Koshlong				3		3		3				3			2	1
Lavielle	3			1		1		3			1					1
Long	2						3	1		2					1	1
Louisa	1			3		1						1				1
Macdonald			3	3		3		3			3					3
Meach	1			1		3		3				3				
Megisan				3												
Mica							3	3							1	1
Myra	3			3		3						1				
Opinicon							3	1	1	3					1	3
Oram				1		1		3				3				3
Pigeon	2			2				3		2	1	2			1	1
Redrock				1		3		1								
Rice				2		2		1		2	3				1	1
Rideau	2				2		1	1	2	1	1				1	1
Ryan	1					3		2				2				1
Saddle	3			3		3						3				
Salmon					3		3	3		3					3	3
Scugog				1				1						1		1
Shrew				2				1								1
Sill	3												3			
Smoke				3		3		3			1	3				3
Sydenham							1	1	2	3					1	1
Timberwolf				1		1		3			3					3
Timmus	3					1						3				
Turtle							3	3	3						3	1
Twelve Mile			3					3	3		1		3	3	1	1
Upper Rideau							3	1	3		1				1	1
Walkinshaw						2										
Westward	1			1								3				
White Partridge	3			3		3		3			1			1		1
Whitelily	3					1						3				
Whyte	3			3												3

Appendix 1 cont'd.

Lake	Species													
	314	316	317	319	331	332	334	338	339	341	342	361	381	382
SHORT TERM STUDIES														
Aloft														
Andre														
Arliss														3
Barry								3			3			
Basshaunt		1												
Bauldry					1			3			3			3
Bell		3	2					3						
Bell		1	1		1									
Big Porcupine					1									
Bigwind					1									
Black Trout								1						3
Blackwater		3			1									
Bonnechere														
Borzoi								3						
Buck		1			1									
Buck														
Carlyle		1			1									
Catfish					1		1	3						3
Chub		3	3		1									
Clear					1									
Clear		2												
Crown					1									
Dickie		2	3		1									
Evangeline	3	1	3		1		1	2		2	2			
Fawn		1	3		1									
George	3				1									
Goetz					1						3			3
Gullfeather			3		3									
Gun		1			1									
Healey		1			1									
Heeney		1			3									
Hele	1	1			1			2		2				
Isabella		1	3		1		1							
Ishmael	1	1			1			2		2				
Izaak														
Johnie					1									
Kakakise		1			1			2		2				
Killarney					1									
Kimball		1			1									
La Cloche	3	1			1		1	2		2				
Leech		1	1		1									
Lena							3							2
Leonard		1			1									
Little Clear		3			1			3						

AHIS and Fish Species Presence

Appendix 1 cont'd.

Lake	Species													
	314	316	317	319	331	332	334	338	339	341	342	361	381	382
SHORT TERM STUDIES														
Little Kennisis		3			1									
Little Sequin		1												
Long		3			1									
Low	1	1			1					2				
Mahzenazing		1			1		2							
Manetawan					1									
Maple		1			3									
McKay		1	3		1									
Mildred							3							3
Molybdenite														
Moot		2	1		3									
Moran														
Muriel					1									
Mutton		1	1		1									
North Grace														
Norway					1									
Nunikani		1	2		3									
Owl					1			2						
Parks					1									
Perry														
Ponsford		1												
Rain		1			1									
Raven		1			2									
Red Pine		1	3		1									
Roller					1		3							3
Sausage					1	3	3							
Selkirk														
Seymour														
Shawanaga		1	3		1		2	2		2				
Sherborne		3			2									
Solitaire		1			1			3						
Strobus					3		3							
Sugar		1			1									
Swan			3		1									
Terry					1									
Tim														
Toodee														
Tyson		1	2		1									
Vanreek					1									
Walker		1			1			3						
Wallace					1						3			
Ward					3									
West Andre														
Wing														

AHIS and Fish Species Presence

Appendix 1 cont'd.

Lake	Species													
	314	316	317	319	331	332	334	338	339	341	342	361	381	382
LONG TERM STUDIES														
Astonish														
Aylen		1			1			3						
Balsam	2	1	1		1		1	1	3					
Billy					3									
Buckhorn		1	1		1		1	1			1		1	
Charleston	3	1	1	3	1					3				
Chemung		1	1		i		1	1					2	
Clean		3			1									
Clear	1	1	3	1	1									
Decourcey					1		1							
Delano					2									
Devil	1	1	1	3	1						3			
Dickey		1	3		1									
Dickson					1									
Disraeli					1			2						
Drag		1	3		1			3						
Dropledge														
Elliot		3						2						
Flack								3						
Gong								1						
Goulais								3						
Havelock					2									
Hicks														
Johnson		3			1									
Kelly		3			1									
Kennisis		1			1									
Koshlong		1	3		1									
Lavielle					1									
Long	1	1	1		1						3			
Louisa														
Macdonald					3									
Meach					3									
Megisan								3						
Mica	1		1		1									
Myra														
Opinicon	1	1	1	1	1					3		2		
Oram														
Pigeon		1	1		1		3							
Redrock					1									
Rice		1	1		1		1	2			2			
Rideau	1	1	1	1	1		1	2				2		
Ryan					3									
Saddle														
Salmon	3	1	3		3			3		3				

Appendix 1 cont'd.

Lake	Species													
	314	316	317	319	331	332	334	338	339	341	342	361	381	382
LONG TERM STUDIES														
Scugog		1	1		1	3	1	1						
Shrew					1									
Sill										3				
Smoke		1			1									
Sydenham	1	1	1	1	1									
Timberwolf					1									
Timmus					1		3	3						
Turtle		1	1		1			3						
Twelve Mile		1	1		1									3
Upper Rideau	1	1	1	3	1		1			3		3		
Walkinshaw					1									
Westward														
White Partridge					1			3						
Whitelily					1			3						
Whyte			3		1									

Appendix 2. Fish sampling methods of the long and short term studies.

Researchers	Fishing gear	Dates
	SHORT TERM STUDIES	
Harvey and Lee (1980a)	gill nets (various mesh) trap nets (2 sizes) plexiglass traps baited minnow traps	1980
Harvey and Lee (1980b)	gill nets (various mesh) trap nets (2 sizes) seine nets baited minnow traps	1979
Malinsky (1984)	gill nets (various mesh) seine nets baited minnow traps baited plexiglass traps dip nets piscicide	1983
Somers (1980)	gill nets (various mesh) trap nets (2 sizes) plexiglass traps baited minnow traps seine net dip net	1978, 1979*
Stewart (1983)	gill nets (various mesh) trap net baited minnow trap	fall 1982
	LONG TERM STUDIES	
Algoma FAU	gill nets (various mesh)* trap nets (2 - 4 sizes) electrofisher* plexiglass trap* minnow traps hoop net* fry traps*	1981 - 1984*
Algonquin FAU	gill nets (various mesh) trap nets (1 - 2 sizes) minnow trap windermere trap plexiglass trap electrofisher*	1978 - 1984*

* not for all lakes

Appendix 2 cont'd.

Researchers	Fishing gear	Dates
Haliburton-Hastings FAU	gill nets windermere trap minnow traps seine net limnetic fry sampler stomach contents creel survey	1978, 1981 - 1985*
Kawartha Lakes FAU	trap nets (3 sizes)	1972 - 1976, 1978 - 1984*
Rideau Lakes FAU	gill nets (various mesh) trap nets (4 sizes) seine net electrofisher*	1981 - 1985*
Age and Growth FRU	gill nets (various mesh) trap nets electrofisher creel survey	1979 - 1985*
Brook Trout FRU	gill nets (various mesh) trap net* minnow trap* seine* creel survey*	1965 - 1985*
Thunder Bay FRU	gill nets (various mesh) trap net* plexiglass trap* minnow trap* hoop net* K-trap* seine* piscicide*	1977,1979 - 1982,1984*

* not for all lakes

Appendix 3. Fishes found in the lakes in this study.

Fish species	OMNR species number
Alewife	61
Rainbow trout	76
Brown trout	78
Brook trout	80
Lake trout	81
Splake (lake trout X brook trout)	82
Lake whitefish	91
Lake herring	93
Round whitefish	102
Rainbow smelt	121
Northern pike	131
Muskellunge	132
Central mudminnow	141
Longnose sucker	162
White sucker	163
Shorthead redhorse	171
Northern redbelly dace	182
Finescale dace	183
Lake chub	185
Common carp	186
Brassy minnow	189
Golden shiner	194
Common shiner	198
Blackchin shiner	199
Blacknose shiner	200
Spottail shiner	201
Spotfin shiner	203
Mimic shiner	206
Bluntnose minnow	208
Fathead minnow	209
Blacknose dace	210
Longnose dace	211
Creek chub	212
Fallfish	213
Pearl dace	214
Yellow bullhead	232
Brown bullhead	233
American eel	251
Banded killifish	261
Burbot	271
Brook stickleback	281
Ninespine stickleback	283
Trout-perch	291
Rock bass	311
Pumpkinseed	313
Bluegill	314
Smallmouth bass	316
Largemouth bass	317

Appendix 3 (Cont'd).

Fish species	OMNR species number
Black crappie	319
Yellow perch	331
Sauger	332
Walleye	334
Iowa darter	338
Fantail darter	339
Johnny darter	341
Logperch	342
Brook silverside	361
Mottled sculpin	381
Slimy sculpin	382

Appendix 4. Lake morhphometry, number of fish species, and data source from long and short term studies for each lake.

Lake	Lat	Long	Year of AHIS	Number of species		Lake morhophomtry			Other data source
				AHIS	Other source	Area (Ha)	Max depth (m)	Mean depth (m)	
	SHORT TERM STUDIES								
Aloft	4818	8427	1976	3	10	106.2	28.1	7.9	Somers
Andre	4808	8437	1971	4	7	61.2	22.3	6.3	Somers
Arliss	4803	8443	1971	3	5	61.2	22.3	7.8	Somers
Barry	4821	8420	1971	6	10	43.7	11.6	3.9	Somers
Basshaunt	4507	7828	1976	5	5	47.5	23.8	8.1	H&L a
Bauldry	4806	8439	1971	8	13	51.4	63.1	23.9	Somers
Bell	4608	8111	1972	11	11	281.5	26.8	8.0	H&L b,Malinsky
Bell	4532	8002	1980	6	10	57.7	12.8	5.1	Malinsky
Big Porcupine	4527	7837	1975	4	8	235.4	31.7	7.5	Stewart
Bigwind	4503	7903	1975	10	11	106.6	36.3	7.8	H&L a
Black Trout	4803	8450	1972	10	14	178.5	22.9	7.0	Somers
Blackwater	4525	7949	1973	5	7	83.0	7.9	3.1	Malinsky
Bonnechere	4528	7835	1975	3	5	104.6	22.0	6.4	Stewart
Borzoi	4802	8425	1979	8	13	83.4	29.0	10.8	Somers
Buck	4523	7900	1975	4	6	39.5	26.8	15.1	H&L a
Buck	4541	7910	1973	4	7	87.1	45.8	13.6	Stewart
Carlyle	4603	8117	1972	8	7	149.9	14.6	5.9	H&L b
Catfish	4806	8448	1969	6	12	156.7	40.3	11.7	Somers
Chub	4513	7859	1972	3	8	33.0	26.5	9.2	H&L a
Clear	4511	7843	1973	3	4	96.3	29.6	11.8	H&L a
Clear	4516	7947	1973	5	4	220.2	44.5	16.2	Malinsky
Crown	4526	7840	1971	5	7	136.1	32.0	8.2	Stewart
Dickie	4509	7905	1976	5	9	91.1	12.2	4.9	H&L a
Evangeline	4608	8152	1972	14	11	385.2	19.2	5.2	H&L b
Fawn	4510	7915	1972	8	12	86.7	7.9	3.4	H&L a
George	4602	8124	1972	10	11	148.0	36.6	18.6	H&L b
Goetz	4807	8439	1971	8	11	71.2	33.9	8.6	Somers
Gullfeather	4506	7901	1974	1	7	61.6	11.0	3.7	H&L a
Gun	4512	7850	1975	6	8	67.1	15.9	4.5	Stewart
Healey	4505	7911	1972	8	8	119.1	7.0	2.8	H&L a
Heeney	4508	7906	1973	4	7	21.5	5.8	2.8	H&L a
Hele	4607	8134	1973	11	7	68.4	41.2	21.6	H&L b
Isabella	4524	7949	1971	5	6	46.3	7.9	2.6	Malinsky
Ishmael	4607	8136	1973	8	10	178.9	14.6	5.9	H&L b
Izaak	4644	8318	1972	12	7	65.4	19.8	12.5	Malinsky
Johnnie	4606	8114	1972	5	3	69.7	30.5	8.6	H&L b
Kakakise	4603	8119	1972	9	7	395.7	33.6	7.9	H&L b
Killarney	4604	8121	1972	16	10	118.9	30.5	12.2	H&L b
Kimball	4521	7841	1975	4	3	357.5	61.0	9.7	Stewart
La Cloche	4608	8203	1972	9	7	212.6	67.1	22.5	H&L b

Appendix 4 (Cont'd).

Lake	Lat	Long	Year of AHIS	Number of species		Lake morhophomtry			Other data source
				AHIS	Other source	Area (Ha)	Max depth (m)	Mean depth (m)	
Leech	4503	7906	1975	14	10	1089.1	30.5	16.3	H&L a
Lena	4804	8441	1970	7	7	82.1	13.7	6.3	Somers
Leonard	4504	7927	1976	5	7	91.5	38.1	11.0	H&L a
Little Clear	4524	7859	1975	7	9	189.1	18.3	6.8	H&L a
Little Kennisis	4515	7835	1976	6	14	10.8	21.4	7.1	Stewart
Little Sequin	4523	7948	1969	4	10	229.6	43.9	15.1	Malinsky
Long	4542	7911	1968	7	6	87.0	23.5	10.1	Stewart
Low	4606	8134	1973	9	10	175.8	39.7	13.9	H&L b
Magnetawan	4540	7859	1976	6	9	53.0	20.4	7.6	Stewart
Mahzenazing	4604	8110	1968	9	8	30.3	28.4	16.3	Malinsky
Maple	4522	7948	1969	8	4	93.6	16.8	6.1	Malinsky
McKay	4503	7910	1971	5	8	201.3	14.3	6.2	H&L a
Mildred	4804	8441	1971	8	8	138.5	19.2	4.8	Somers
Molybdenite	4803	8458	1978	6	11	69.3	27.8	8.8	Somers
Moot	4508	7910	1973	1	1	93.6	49.0	8.1	H&L a
Moran	4801	8446	1971	3	5	18.3	14.0	3.5	Somers
Muriel	4603	8126	1972	7	4	22.6	12.2	7.0	H&L b
Mutton	4521	7946	1972	8	8	45.0	5.5	1.8	Malinsky
North Grace	4526	7832	1972	5	9	94.0	25.3	6.1	Stewart
Norway	4605	8118	1972	1	1	60.5	33.6	14.6	H&L b
Nunikani	4512	7844	1973	5	7	115.7	24.1	7.9	Stewart
Owl	4608	8208	1973	8	6	86.0	2.4	0.9	H&L b
Parks	4807	8437	1971	4	9	31.5	20.7	7.4	Somers
Perry	4813	8437	1971	4	3	30.4	15.3	4.0	Somers
Ponsford	4521	7941	1968	2	5	49.4	22.9	9.9	Malinsky
Rain	4537	7856	1974	5	8	168.5	23.5	5.5	Stewart
Raven	4512	7851	1973	12	6	560.7	41.8	8.1	Stewart
Red Pine	4512	7842	1971	6	9	380.3	38.7	8.9	Stewart
Roller	4755	8450	1976	4	9	18.2	17.7	8.5	Somers
Sausage	4822	8433	1975	3	7	56.5	25.9	10.2	Somers
Selkirk	4813	8436	1971	4	4	34.4	24.1	4.3	Somers
Seymour	4645	8314	1973	10	12	57.3	16.8	5.9	Malinsky
Shawanaga	4534	7959	1975	9	7	222.0	17.7	5.8	Malinsky
Sherborne	4511	7847	1973	7	6	252.0	35.1	9.5	Stewart
Solitaire	4523	7901	1975	7	11	122.5	29.0	10.9	H&L a
Strobus	4819	8424	1974	1	6	63.5	31.4	13.0	Somers
Sugar	4522	7946	1971	7	7	148.9	16.8	6.0	Malinsky
Swan	4530	7842	1975	3	11	81.5	19.2	6.3	Stewart
Terry	4604	8117	1972	5	4	10.1	8.0	3.5	H&L b
Tim	4545	7902	1974	8	11	182.7	19.8	6.8	Stewart
Toodee	4645	8310	1974	9	10	138.7	36.0	12.5	Malinsky
Tyson	4607	8107	1971	9	10	1143.1	39.7	11.9	H&L b,Malinsky
Vanreek	4802	8438	1977	5	6	50.3	31.4	10.0	Somers

Appendix 4 (Cont'd).

Lake	Lat	Long	Year of AHIS	Number of species		Lake morhophomtry			Other data source
				AHIS	Other source	Area (Ha)	Max depth (m)	Mean depth (m)	
Walker	4522	7904	1970	3	6	74.9	15.3	4.8	H&L a
Wallace	4808	8432	1971	6	8	27.1	19.2	6.6	Somers
Ward	4757	8445	1969	3	8	15.4	19.5	3.5	Somers
West Andre	4809	8440	1971	1	7	83.8	29.3	9.9	Somers
Wing	4802	8453	1979	3	3	28.7	5.0	1.6	Somers
	LONG TERM STUDIES								
Astonish	4634	8250	1970	4	7	79.4	15.6	5.4	ALFAU
Aylen	4537	7751	1972	7	16	2016.1	72.9	27.2	APFAU
Balsam	4435	7850	1972	17	21	4668.4	12.8	5.0	KLFAU
Billy	4538	7807	1971	5	11	90.9	7.6	4.9	BTFRU
Buckhorn	4429	7823	1972	16	17	3191.2	14.3	2.1	KLFAU
Charleston	4432	7600	1972	14	18	2519.1	91.5	17.4	RLFAU
Chemung	4425	7822	1972	18	16	2279.7	6.4	2.4	KLFAU
Clean	4515	7832	1971	6	12	160.5	43.3	14.8	AGFRU
Clear	4433	7628	1969	10	13	169.0	61.0	20.4	RLFAU
Decourcey	4859	8914	1970	6	7	263.7	14.0	4.6	TBFRU
Delano	4532	7834	1975	7	14	26.1	18.6	6.6	APFAU
Devil	4435	7627	1971	10	19	1062.3	44.5	14.4	RLFAU
Dickey	4447	7744	1976	7	19	207.9	50.9	18.4	HHFAU
Dickson	4547	7812	1975	5	18	975.4	16.8	5.5	APFAU,BTFRU
Disraeli	4907	8859	1970	8	7	445.1	32.9	10.6	TBFRU
Drag	4505	7824	1975	10	24	911.7	55.5	20.1	HHFAU
Dropledge	4516	7731	1974	2	5	18.0	11.6	4.1	HHFAU
Elliot	4623	8242	1969	12	14	615.6	38.1	15.6	ALFAU
Flack	4635	8247	1967	5	13	934.7	70.2	21.6	ALFAU
Gong	4705	8332	1969	10	14	384.8	21.4	6.9	ALFAU
Goulais	4710	8340	1965	6	10	239.8	33.6	8.1	ALFAU
Havelock	4517	7838	1976	5	7	196.3	33.5	10.2	AGFRU
Hicks	4522	7750	1977	4	11	36.0	23.8	6.5	HHFAU
Johnson	4516	7837	1971	7	7	151.2	45.1	18.3	AGFRU
Kelly	4515	7837	1971	6	12	98.7	35.7	11.7	AGFRU
Kennisis	4513	7838	1971	15	15	26.5	14.5	5.0	AGFRU
Koshlong	4458	7829	1970	7	14	401.2	42.7	10.4	HHFAU
Lavielle	4551	7814	1975	15	19	2427.6	48.8	14.4	APFAU
Long	4448	7615	1970	13	13	85.1	19.8	5.0	RLFAU
Louisa	4528	7829	1972	9	14	489.6	61.0	17.0	APFAU
Macdonald	4514	7834	1968	3	15	137.9	39.7	10.8	AGFRU
Meach	4518	7808	1972	5	12	43.7	12.2	4.2	HHFAU
Megisan	4715	8332	1971	4	9	628.2	18.0	5.8	ALFAU
Mica	4427	7633	1975	7	9	23.9	4.9	1.4	RLFAU

Appendix 4 (Cont'd).

Lake	Lat	Long	Year of AHIS	Number of species		Lake morhophomtry			Other data source
				AHIS	Other source	Area (Ha)	Max depth (m)	Mean depth (m)	
Myra	4538	7821	1969	2	9	5.7	8.5	2.5	BTFRU
Opinicon	4434	7619	1972	16	15	787.3	10.7	2.5	RLFAU
Oram	4538	7806	1971	5	12	25.8	20.7	6.7	BTFRU
Pigeon	4427	7830	1972	21	17	5348.6	17.4	3.0	KLFAU
Redrock	4546	7828	1972	9	15	290.8	20.4	6.2	APFAU
Rice	4412	7810	1972	20	12	10026	13.4	2.6	KLFAU
Rideau	4445	7613	1972	28	23	6484.1	100.0	12.3	RLFAU
Ryan	4541	7806	1971	7	8	49.8	9.8	3.8	BTFAU
Saddle	4657	8347	1967	1	6	110.6	15.3	3.9	ALFAU
Salmon	4432	7630	1969	4	20	148.2	42.4	13.3	RLFAU
Scugog	4410	7850	1968	16	18	8262.0	7.6	1.4	KLFAU
Shrew	4542	7805	1971	9	7	36.5	8.8	3.8	BTFRU
Sill	4646	8415	1964	5	9	36.9	19.8	6.5	ALFAU
Smoke	4531	7841	1969	7	17	607.5	54.9	16.2	APFAU
Sydenham	4425	7633	1974	13	15	451.2	36.6	6.8	RLFAU
Timberwolf	4541	7848	1975	7	10	167.9	20.4	7.0	APFAU
Timmus	4840	8905	1970	4	12	17.6	22.0	5.6	TBFRU
Turtle	4439	7815	1974	5	12	40.0	11.3	3.8	HHFAU
Twelve Mile	4501	7843	1974	11	22	336.8	27.5	12.0	HHFAU
Upper Rideau	4441	7620	1970	16	20	1363.2	22.0	8.1	RLFAU
Walkinshaw	4838	8904	1970	4	4	36.7	10.7	3.2	TBFRU
Westward	4529	7847	1970	7	9	62.8	44.8	20.9	APFAU
White Partridge	4550	7806	1975	10	17	574.8	47.3	15.3	APFAU
Whitelily	4840	8905	1970	5	9	42.1	4.3	1.3	TBFRU
Whyte	4505	7735	1971	4	9	37.9	38.1	13.5	HHFAU